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Structure of Land Use Change and Its Affecting Factors: Based on Hubei Province

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Abstract

The land use study is very important to reveal the causes of land use change, the internal mechanisms and basic processes, also it is used to predict future trends and changes in the results, and the development of countermeasures. Based on the emprocal study of land use structure, land use factors, and land use speed in Hubei Province, we concluded that land use speed of hubei province is stability, but the land use ordering is not enough. And Hubei Province government can adapt technical advances and other means to improve Land use efficiency.

Keywords: land use; land use speed; land use structure; hubei province

1. Introduction

The land use study is very important to reveal the causes of land use change, the internal mechanisms and basic processes; also it is used to predict future trends and changes in the results, and the development of countermeasures. In the abroad existing studies, there were two dimensions about land use, one focused on the global scale changes in land use types and the othere focused on the causes of factors on land uses. At the regional scale, Santini considered that the human aspects of the driving forces are population, technology, wealth, political structure, trust, and attitudes; Ehrich pointed out that the population, given the extent of human and technology is the driving force of the main aspects; Turner pointed out that the driving force of the human population should be included, income, technology, political economy and culture. IHDP will affect the driving factors of land use factors are divided into direct and indirect factors, indirect factors include six areas: demographic change, economic growth, technological development, political and economic policies, wealth and values. Factors through a direct effect on their land, which

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includes products for land demand, land investment, land use intensity, land tenure, land use policies, and attitudes towards land resources conservation.

On the Chinese national level, researchs on land use mainly concentrated in two areas: one was human and natural driving force is very active in the "hot spots." Some Chinese using different periods of land use remote sensing image on the mechanism of land use in Beijing were studied, that capital, land, labor and technology and the four factors of production, in modern Chinese urban land use change played vital important role. Liu studied the Shenzhen Special Economic Zone as the rapid economic development, land use typical fast-changing areas, through regression analysis, land use change in Shenzhen City, human driving force. Lee used the basic competition model of land use on land-use change at this stage of the driving force of the macro analysis, the results showed that: the western region in order to survive the economic welfare and environmental security-driven main drive, while the eastern region to Comparison of economic welfare and food safety drive the main drive. Fang use SPSS software on urban land use change and its driving force is analyzed, that population, urbanization level, GDP and other economic factors are the type of land use change in the most important factor, followed by advances in agricultural technology. The other is economic development, resource depletion and population growth occurs under a variety of "vulnerability zone." Maoyan Cheng used the example of Zhangye City on Land Use Change in the social economic and natural driving forces analysis showed that social and economic driving force in Zhangye City land use change plays a dominant role in the natural driving forces is relatively small.

Overall, the strong role of natural factors, the low level of economic development areas, land use change is the main driving force of climate, hydrology and other natural conditions; development of a long history, and less constrained by natural conditions, economic development higher areas of land use change is the main driving force of economic development (industrialization, urbanization), population growth, socio-economic conditions and policy.

2. Land use condition of Hubei province

2.1 Regional conditions

Hubei province is located in the central of China, acrossed by the Yangtze River from east to west, provincial high terrain on three sides was low in the middle, the total area of 185,900 square kilometers of land, jurisdiction over 12 provinces and cities, 1 autonomous region and 38 municipal districts, 24 county-level cities (including three straight city 37 counties, 2 autonomous counties and 1 forest). In 2009, the province's GDP of 1.283152 trillion yuan to complete, according to comparable prices, an increase of 13.2%, for 6 years to maintain double-digit growth. In the GDP of Hubei province, primary industry added value of 191.59 billion yuan, an increase of 5.2%; the second industry added value of 590.942 billion yuan, up 16.0%; the added value of tertiary industry was 500.62 billion yuan, an increase of 12.3%.

2.2 Land use change

Land use in Hubei Province was named “seven mountains of water two and a field" pattern. According to survey data in late 2008 to change the province an area of 27,883.26 hectares across the province class. In the aii kinds of land, there were 21,977.67 acres of agricultural land, 2100.61 mu of construction land, unused land 3804.98 mu, accounting for the province area area (27,883.26 acres) of 78.82%, 7.53%, 13.65%. From the sub-indicators, from 2004 to 2008, various types of land use as follows: Class of 2004 across the province (one class) at the end of number: 219990.68 acres of agricultural land, 2033.03 mu of land for construction, not use of land 3859.54 mu, accounting for 78.87% area of the province's area, 7.29%, 13.84%. All kinds of land can be seen as table1.

Table 1：Land use of hubei province（2004-2008）

	2003	2004	2005	2006	2007	2008
land	7077.12	7036.48	7012.75	6998.05	6995.03	6996.18
garden	638.57	642.66	639.81	640.21	639.32	636.71
woodland	11854.73	11878.3	11908.37	11912.34	11908.91	11905.35
pasture	81.9	76.61	66.7	66.59	66.59	66.53
Other agricultural land	2347.5	2356.63	2368.13	2375.4	2374.31	2372.9
Residential and industrial land	1453.8	1464.82	1477.36	1488.74	1500.51	1512.84
Land transportation	116.84	120.19	125.36	129.49	134.9	137.53
Water infranstucture	445.95	448.04	448.64	449.23	449.88	450.24
unused land	2323.44	2310.99	2268.38	2257.75	2249.96	2242.73
other land	1543.41	1548.56	1567.77	1565.47	1563.88	1562.26

3. Analysis of land use change

Then, in the follwing analysis, the paper will analysis the land use change of hubei province from land use speed and land use stucture. Based on the land use speed and land use stucture analysis, we will use a factor analysis methods to show which are the main factors to impact the land use change of Hubei province.

3.1 Land use speed

According to the land use model, as to analyze the dynamic changes of land use in Hubei Province, the use of land use dynamics equation is:

$$K = \frac{Ub - Ua}{Ua} \times \frac{1}{T} \tag{1}$$

In the Equation, K is representing the land use dynamic degree, Ua and Ub are representing the number of land use types, T is representing he length of time. In this study, the T value is set, we will have 2003 to 2008 time series is divided into 2003 to 2006 and 2006 to 2008, and 2003 to compare the three periods in 2008, through the use of Table 1 Data calculated from various land use types in Hubei Province at different times of the dynamic degree, in Table 2.

Table 2：Land use change ratio of hubei province

	K1（2003-2006）	K2（2006-2008）	K3（2003-2008）
land	-0.003	-0.00009	-0.002
garden	0.00064	-0.0019	-0.0005
woodland	0.001	-0.0002	0.0007
pasture	-0.047	-0.00029	-0.03
Other agricultural land	0.003	-0.00035	0.002
Residential and industrial land	0.006	0.0053	0.007
Land transportation	0.027	0.021	0.03
Water infranstucture	0.002	0.00075	0.0016
unused land	-0.007	-0.0023	-0.006
other land	0.004	-0.00068	0.002

3.2 Land stucture use change

The land itself is a complex system of dissipative structure with the structure and function of the order of features. Information entropy can be from a macro point of view of the dynamic changes of land use structure and the degree of ordering, indicating structural changes in land use and conversion level. Shannon entropy formula in accordance with the information entropy (H) is defined as follows:

$$P_i = \frac{A_i}{A} \tag{2}$$

$$H = -\sum_{i=1}^{n} P_i \times LnP_i \tag{3}$$

In the above equation, A is representing total land area, said area, Ai said that all types of land area, Pi is representing the region accounts for all types of land area percentage of the total land area, H is representing the entropy of land use structure, H is representing the size of the reflect the amount or type of land use and land-use types of the uniformity of the distribution area. Using 2003-2008 data on land use structure in Hubei Province, we calculated in Hubei Province from 2003 to 2008 the value of land use structure change of entropy, the specific results in Table 3

Table 3：Land use H value change （2003-2008）

	2003	2004	2005	2006	2007	2008
land	0.25	0.25	0.25	0.25	0.25	0.25
garden	0.02	0.02	0.02	0.02	0.02	0.02
woodland	0.44	0.44	0.44	0.43	0.43	0.43
pasture	0	0	0	0	0	0
Other agricultural land	0.08	0.08	0.08	0.09	0.09	0.09
Residential and industrial land	0.05	0.05	0.05	0.05	0.05	0.05
Land transportation	0	0	0	0	0	0
Water infranstucture	0.02	0.02	0.02	0.02	0.02	0.02
unused land	0.08	0.08	0.08	0.08	0.08	0.08
other land	0.06	0.06	0.06	0.06	0.06	0.06
H	1.5881	1.5881	1.5881	2.2027	2.2027	2.2027

The results in Table 3, we find that changes in land use structure in Hubei Province from 2003 to 2008 period, the land use structure can be divided into two stages of the more obvious, namely, 2003-2005 and 2006 to 2008. In both periods, the entropy values show a clear upward trend. Also in the table 3 shows the entropy of land use structure in Hubei Province in 2006 increased significantly, indicating that after 2006, showing land use structure in Hubei Province is more disorder and chaos. Relative to the national land use structure in the average entropy (1.6515) point of view, Hubei Province in 2005, ordered before the land use structure is higher than the national average, after 2006, while the level of land use structure and orderly downward trend lower degree of order, disorder increases, and higher than the national average.

3.3 Factor analysis of land use change

Land-use change by natural driving forces, socio-economic driving forces and land-use policy-driven interaction force in a relatively short time scale relative to the social and economic driving forces and driving forces of land use policy, natural driving forces of land use change. The role is very weak, this study constructed the index system of the previous basis, according to Hubei Province, the actual situation of land use change, based on the principle of representativeness and availability, select reflect population growth, economic growth and technological progress factors as the analysis of 12 indicators, the use of

stepwise regression of empirical research methods, to clarify the different types of land use change in Hubei Province, the driving factor.

Table 4：Index of land use change

factor	code	index	details
population	X1	total population	
growth	X2	population density	
	X3	level of urbanization	urban population / total population
Economic	X4	GDP	
growth	X5	fixed asset investment	
	X6	Total retail sales of social consumer goods	
	X7	Economic Conversion rate	and tertiary industry GDP / total GDP
	X8	total fiscal revenue	
technological	X9	grain yield	grain yield / grain crops sown
progress	X10	Highway Passenger Traffic	
	X11	Highway Freight Traffic	
	X12	Total Power	

Standardized treatment using SPSS17 by stepwise regression models were tested, isolated from the total population, economic conversion rate, grain yield, road freight, gross agricultural machinery and other 5 factors tested by the model. For different land types, standardized coefficients reflect the different factors on the contribution of different types of land use degree

Table 5：Factors of land use change

Kinds of land	total population	Economic Conversion rate	grain yield	Highway Freight Traffic	Total Power	Adjust R^2
land	-0.45	-1.394	-1.966	0.591	1.633	0.95
garden	0.076	1.328	3.131	-1.068	-3.414	0.94
woodland	0.719	1.608	1.785	-0.711	-1.770	0.96
pasture	-0.709	-1.263	-1.215	0.619	1.038	0.95
Other agricultural land	0.448	1.530	1.771	-0.551	-1.579	0.92
Residential and industrial land	0.068	0.338	0.531	-0.006	0.243	0.97
Land transportation	0.008	0.081	0.217	-0.229	0.946	0.98
Water infranstucture	0.277	0.892	1.630	-0.416	-0.968	0.98
unused land	-0.399	-0.773	-0.612	0.348	0.087	0.97
other land	0.886	1.297	0.889	-0.762	-0.862	0.95

Land use types in a significant impact on the 5 factors, the increase in the total population of the total arable land, grassland total amount of unused land have a negative impact, including the negative impact on the grassland, followed by the total arable land volume; economic conversion rate increase is mainly on farmland and grassland had a negative impact of total, in which the most negative effects of land; grain yield increase of cultivated land had a greater negative impact, followed by the negative impact Land types include grassland and unused land; highway passenger volume increased primarily on the amount of garden and woodland had a greater negative impact; Total Power Fox Spirit to increased amount of garden and woodland produced a larger negative.

4. Conclusions

In the above Empirical Analysis, it can be found that as follwed. Firstly, in the Hubei Province, the overall stability of land use change in speed, but speed in the use of different types of land there are still differences, land use of the stability and speed of the speed difference between different land use mainly by government land policies, the country's strict control of land resources, especially for farmland and forest land and other resources, control of agricultural land, limiting the land use of the speed of Hubei Province increase. Also by environmental changes, some of the larger environmental constraints by type of use of land reflect a certain rate volatility. Secondly, the Hubei Province of land use structure of the disorder increases. As land resources are the basis of the role of economic development, so as to accelerate economic growth in Hubei Province and a strong desire for economic growth, land use showing a greater disorder, and this land use structure of the high disorder at the national level. This disorder on the one hand from behind the work of land consolidation in Hubei Province, on the other hand the lack of overall planning of land from the timeliness and forward-looking. Thirdly, the impact of land use in Hubei Province factors, the current factors that affect land use in Hubei Province mainly in the field of technological progress, technological progress and technological innovation can make land use activities in Hubei Province and integration of resources is more reasonable.

Therefore, in Hubei Province in the future, more rational and orderly use of limited land resources, the paper proposes the following policy recommendations:Firstly, to strengthen supervision of land policy to improve the sustainability of land use policy. Government is highly concerned land issues, introduced a number of land policy, however, policy implementation and policy did not achieve seamless supply, resulting in a policy-free and, therefore, strengthen the supervision of land policy, land policy to improve the sustainability of the rational use of limited land resources is important.Secondly, the integration of the province's land resources, development of time-sensitive and forward-looking land use planning. Land use planning is land use baton, therefore, to considering the stock and flow of land resources, as well as the relationship between economic development and fully integrate the province's land resources, the realization of Hubei Province, the sustained, healthy development Meanwhile, the intensive use of limited land resources. Thirdly, encourage technological innovation, and improve land productivity. Technical progress for the key role of land use in Hubei Province, through technological innovation, can not increase the area based on land use, increased output per unit area, land use and economic development to achieve win-win situation.

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